AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 | 4

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0002	11-Jul-2002	W22W9K-2140-3617	

6. ISSUED BY CODE DACA27
USA ENGINEER DISTRICT, LOUISVILLE
ATTN: CELRL-CT
600 DR. MARTIN LUTHER KING PLACE
ROOM 821
LOUISVILLE KY 40202

7. ADMINISTERED BY (If other than item 6) CODE DACA27
CONTRACT ADMINSTRATION BRANCH
ATTN: KIMBERLY J. MCKNIGHT
P. O. BOX 59
LOUISVILLE KY 40201-0059

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

CODE FACILITY CODE

X	9A. AMENDMENT OF SOLICITATION NO. DACA27-02-R-0016
X	9B. DATED (SEE ITEM 11) 11-Jun-2002
	10A. MOD. OF CONTRACT/ORDER NO.
	10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Subject Solicitation, DACA27-02-R-0016, Aircraft Maintenance Hangar and Fuel Cell Hangar, Maxwell AFB, Montogmery, AL, is amended as follows:

SEE ATTACHED FOR AMENDMENT INFORMATION

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)	16C. DATE SIGNED 11-Jul-2002

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

Changes in Section SF 30

CONTRACTUAL SPECIFICATIONS

1. Section 00100, FAR 52,236-27, Site Invesitgation (Construction) February 1995, the POC is changed from Jerry Cappadona to Jerry Abernathy. Mr. Abernathy can be reached at (334) 953-7028, 25 LeMay Plaza, South, Bldg 853, Maxwell AFB, AL 36112.

TECHNICAL SPECIFICATIONS AND DRAWINGS

2. Refer to Specification Section 10520, Fire Extinguishers:

Delete previous specification section and replace with revised specification with addendum changes annotated in **bold** lettering.

3. Refer to Specification Section 13920, Fire Pumps

Delete previous specification section and replace with revised specification with addendum changes annotated in **bold** lettering.

4. Refer to Specification Section 13930, Wet Pipe Sprinkler System, Fire Protection

Delete previous specification section and replace with revised specification with addendum changes annotated in **bold** lettering.

5. Refer to Specification Section 13991, High Expansion Foam (HEF) Fire Protection & Fire Alarm Systems

Delete previous specification section and replace with revised specification with addendum changes annotated in **bold** lettering.

6. Refer to Sheet M-F4.01, Detail 01, Fire Protection Bladder Room U106.

Add zone identification tags to fire risers and bladder tanks at grids 4B, 5B and 4C.

7. Refer to Sheet M-F5.01, Detail 02, Aircraft Maintenance Hangar Sprinkler Riser.

Revise fire department connection piping as show to isolate foam systems from fire department connection. Add basket strainer to foam system riser.

8. Refer to Sheet F-F4.01, Detail 01, Fire Protection Bladder Room F102.

Add zone identification tags to fire risers at grids B4 and C4.

9. Refer to Sheet F-F5.01, Detail 02, Fuel Cell Sprinkler Riser.

Add check valve to sprinkler riser piping as shown to isolate foam system from fire department connection. Add basket strainer to foam system riser.

10. Refer to Sheet M-S1.01.

The designation WF2 is changed to WF1 on drawing M-S1.01 only.

SECTION 10520

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SUBMITTALS

All submittals classified for Government Approval (G) are identified in the approved submittal register Form 4288. A code following the "G" designation indicates the approving authority; codes of "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire Extinguishers; G, ED

1.2 DELIVERY AND STORAGE

Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer. Protect from damage from handling and construction operations before, during, and after installation. Store materials for door and door frame protection in a dry environment of approximately 21 degrees C for at least 48 hours prior to installation.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

2.1.1 Portable Fire Extinguisher

2.1.2 Wheeled Fire Extinguisher

2.1.3 Polyester Coated - Red Color

2.1.4 Extinguishing Agents

Class B extinguishing agent.

2.2 PORTABLE FIRE EXTINGUISHER

2.2.1 Capacity

***2**
The cylinder shall have a capacity of 4.5 kg.

2.2.1.1 Accessories

Provide cylinder with a pressure gauge, hose.

2.2.1.2 Class Rating

4A 80BC

2.3 WHEELED FIRE EXTINGUISHER

2.3.1 Capacity

The cylinder shall have a capacity of 22.7 kg

2.3.1.1 Accessories

Provide wheeled cylinder with a pressure gauge, hose.

2.3.1.2 Class Rating

320 BC

PART 3 EXECUTION

***2**
Provide fire extinguishers per NFPA 10 and as shown on drawings.

-- End of Section --

SECTION 13920A

FIRE PUMPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2001) Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both
ASTM A 449	(2000) Quenched and Tempered Steel Bolts and Studs
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999el) Ductile Iron Castings
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 563M	(2000) Carbon and Alloy Steel Nuts (Metric)
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 135	(2000) Seamless Brass Tube
ASTM B 135M	(1996) Seamless Brass Tube (Metric)
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 88	(1999) Seamless Copper Water Tube

ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM F 436	(2000) Hardened Steel Washers
ASTM F 436M	(1993) Hardened Steel Washers (Metric)

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C500	(1993; C500a) Metal-Seated Gate Valves for Water Supply Service
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

ASME INTERNATIONAL (ASME)

ASME/ANSI A13.1	(1996) Scheme for the Identification of Piping SystemsRef Title
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1963	(1998) Fire Hose Connections
NFPA 20	(1999) Installation of Centrifugal Fire Pumps
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 37	(1998) Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(2002) National Electrical Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 1247	(1995; Rev thru May 1997) Diesel Engines for Driving Centrifugal Fire Pumps
UL 142	(1993; Rev Jul 1998) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(1994; Rev thru Dec 1998) Gate Valves for Fire-Protection Service
UL 448	((1994; Rev thru May 1999) Pumps for Fire-Protection Service
UL 80	(1996) Steel Inside Tanks for Oil-Burner Fuel
UL Fire Prot Dir	(1999) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Except as modified in this Section or on the drawings, fire pumps shall be installed in conformance with NFPA 20, including all recommendations and advisory portions, which shall be considered mandatory. All reference to the authority having jurisdiction shall be interpreted to mean the Contracting Officer.

1.3 SEQUENCE OF OPERATION

1.3.1 Primary Fire Pump

Primary fire pump shall automatically operate when the pressure drops to 758 kPa . The fire pump shall automatically stop operating when the system pressure reaches 862 kPa and after the fire pump has operated for the minimum pump run time specified herein.

1.3.2 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops to 793 kPa. Pump shall automatically stop when the system pressure reaches 862 kPa and after the pump has operated for the minimum pump run time specified herein.

1.3.3 Safety Requirements

Coupling, rotating parts, gears, projecting equipment, etc. shall be fully enclosed or properly guarded so as to prevent possible injury to persons that come in close proximity of the equipment. The Contractor shall conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

1.4 COORDINATION OF TRADES

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed with protection from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.7 SUBMITTALS

Indicate submittal classification in the blank space following the name of the item requiring the submittal by using "G" when the submittal requires Government approval. Submittals not classified as "G" will show on the submittal register as "Information Only". For submittals requiring Government approval, a code of up to three characters should be used following the "G" designation to indicate the approving authority; codes of "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval are recommended. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Requirements; G, RE

Three copies of the Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20 . Drawings shall indicate equipment, piping, and associated pump equipment to scale. All clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment shall be indicated. Drawings shall include a legend identifying all symbols, nomenclatures, and abbreviations. Drawings shall indicate a complete piping and equipment layout including elevations and/or section views of the following:

a. Fire pumps, controllers, piping, valves, and associated equipment.

b. Sensing line for each pump including the pressure maintenance pump.

c. Restraint of underground water main at entry-and exit-points to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.

d. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.

e. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

As-Built Drawings; G, RE

As-built drawings, no later than 14 days after completion of the Final Tests. The Fire Pump Installation Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Pump Installation Related Submittals; G, RE

A list of the Fire Pump Installation Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist and the Manufacturer's Representative.

Installation Requirements; G, RE

Manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

a. Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.

b. Pressure maintenance pump and controller.

c. Piping components.

d. Valves, including gate, check, globe and relief valves.

e. Gauges.

f. Hose valve manifold test header and hose valves.

g. Flow meter.

h. Restrictive orifice union.

i. Associated devices and equipment.

Spare Parts; G, ED

Spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Test; G, ED

Proposed procedures for Preliminary Tests, at least 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

System Diagrams; G, ED

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

Fire Protection Specialist; G, ED

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings.

Manufacturer's Representative; G, ED

The name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications.

Field Training; G, ED

Proposed schedule for field training submitted at least 14 days prior to the start of related training.

Final Acceptance Test; G, ED

*2

The Contractor shall submit the detailed plans, schedule, procedure, manpower requirement, and equipment necessary for the final test to the contracting officer 60 days prior to the final test for approval.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

SD-06 Test Reports

*2 **Calibration Certificate; G**

All testing equipment shall be calibrated by a certified testing laboratory within the 6 month period prior to the test. Calibration certification shall be provided at the time of testing for all testing equipment.

Preliminary Test; G, ED

Three copies of the completed Preliminary Tests Reports, no later that 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

Final Acceptance Test; G, ED

Three copies of the completed Final Acceptance Tests Reports, no later that 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report.

SD-07 Certificates

Fire Protection Specialist; G, ED

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Fire Pumps; G, ED

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.8 FIRE PROTECTION SPECIALIST

***2**

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection

Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. **Prepare detailed working drawings that are signed and stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.**

1.9 MANUFACTURER'S REPRESENTATIVE

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe and Fittings

Underground piping and piping under the building slab shall be ductile iron with a rated working pressure of 1207 kPa conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation.Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 133 mm in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.4.4 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counterclockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4.5 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 300 mm below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm and Larger

2.5.1.1 Pipe

Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm and greater in diameter),

Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside per NFPA 20.

2.5.1.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.3 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided at valves, connections to equipment, and where indicated.

2.5.1.4 Gaskets

Gaskets shall be AWWA C111, cloth inserted red rubber gaskets.

2.5.1.5 Bolts

Bolts shall be ASTM A 449, Type 1. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.6 Nuts

Nuts shall be ASTM A 193/A 193M, Grade 5.

2.5.1.7 Washers

Washers shall meet the requirements of ASTM F 436M . Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Piping Sizes 50 mm and Smaller

2.5.2.1 Steel Pipe

Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, zinc-coated steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.2.2 Copper Tubing

Copper tubing shall be ASTM B 88M , Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B 42 copper pipe with threaded end connections.

2.5.3 Pipe Hangers and Supports

Pipe hangers and support shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.4 Valves

***2**

Valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire protection service. Valves shall have flange or threaded end connections. **All control valves and gate valves require electronic tamper supervision. Switch shall contain two (2) SPDT (Form C) contacts.**

2.5.4.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

***2**2.5.4.2 Tamper Switch - **DELETED**

2.5.4.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.4.4 Relief Valve

Relief valve shall be pilot operated or spring operated type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.5.4.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.5.4.6 Suction Pressure Regulating Valve

Suction pressure regulating valve shall be FM approved FM P7825a and FM P7825b. Suction pressure shall be monitored through a pressure line to the controlling mechanism of the regulating valve. Valve shall be arranged in accordance with the manufacturer's recommendations.

2.6 FIRE PUMP

Fire pump shall be electric motor driven. Each pump capacity shall be rated at 141.9 liters per second with a rated net pressure of 862 kPa. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal horizontal split case fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.7 ELECTRIC MOTOR DRIVER

Motor shall conform to NEMA MG 1 and be marked as complying with NEMA Design B standards. Motor wattage shall be of sufficient size so that the nameplate wattage rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.8 FIRE PUMP CONTROLLER

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be completely terminally wired, ready for field connections, and mounted in a NEMA Type 2 drip-proof enclosure arranged so that controller current carrying parts will not be less than 300 mm above the floor. Controller shall be provided with voltage surge arresters installed per NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 5 degrees C

2.8.1 Controller for Electric Motor Driven Fire Pump

Controller shall be electronic soft start starting type. Controller shall have a short circuit rating of 18 amps r.m.s. symmetrical at 480 volts a.c. Controller shall monitor pump running, loss of a phase or line power, phase reversal, low reservoir and pump room temperature. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature and low reservoir level), and for remote start. Limited service fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 11 kW . Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa , time, and date. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 149 kW and for 15 minutes for pumps with motors 149 kW and greater, prior to automatic shutdown. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors.

***2**
The fire pump starting sequence will begin automatically when:

1. Pump start signal transmitted from the foam system control panel from either building.

2. Drop in system water pressure in accordance with NFPA 20.

3. The back-up fire pump shall start 10 seconds on failure of lead pump. Only one pump shall be energized at one time.

2.9 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 15

mm H58 brass tubing complying with ASTM B 135M. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm . Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 15 mm globe valves and 8 mm gauge connection tee arranged per NFPA 20. One of the test connections shall be equipped with a 0 to 1380 kPa water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.10 PRESSURE MAINTENANCE PUMP

Pressure maintenance pump shall be electric motor driven, horizontal shaftor in-line vertical shaft, centrifugal type with a rated discharge of 0.63 liters per second at 862 kPa. Pump shall draft from the suction supply side of the suction pipe gate valve of the fire pump and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.10.1 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for 2 minutes.

2.11 **SURGE ARRESTER**

***2**

Provide surge arresters to moderate the potentially destructive effects of pressure surges or water hammer due to pump starting and stopping and valve opening and closing. These hydropneumatic devices absorb pressure surges into a system in a controlled fashion. Surge arresters are installed on the system side of the fire pump discharge check valve and as close to the valve as possible. At least one arrester for fire protection piping, with a volume of not less than 378.4 liters and a rated working pressure not less than 1724 kPa. Provide each arrester with an indicating valve to isolate it from the system. Supervision is not required. Because of the complex effects of system variables on satisfactory performance, the manufacturer should engineer each surge arrester installation.

2.12 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to

ASME B16.22 and ASTM B 75M . Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B 62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A 536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 110 degrees C . Grooved joints shall conform to AWWA C606 Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A 183.

2.13 PUMP BASE PLATE AND PAD

A common base plate shall be provided for each horizontal-shaft fire pump for mounting pump and driver unit. The base plate shall be constructed of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Each base plate for the horizontal fire pumps shall be provided with a 25 mm galvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head assembly. Pump units and bases shall be mounted on a raised 100 mm reinforced concrete pad that is an integral part of the reinforced concrete floor.

2.14 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825b bronze hose gate valves with 65 mm American National Fire Hose Connection Screw Standard Threads (NH) per NFPA 1963. The number of valves shall be per NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 900 mm and no less than 600 mm above grade.

2.15 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM P7825a and FM P7825bas flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. The flow meter shall be arranged in accordance with Figure A-2-14.2.1 of NFPA 20. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Automatic air release shall be provided if flow meter test discharge is piped to the pump suction and forms a closed-loop meter arrangement as defined in Figure A-2-14.2.1 of NFPA 20.

2.16 PIPE SLEEVE

A pipe sleeve shall be provided at each location where piping passes through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Sleeves shall be grouted in position during construction. Sleeve shall be of sufficient length to pass through the entire thickness of the wall, ceilings, roofs and floors. The space between the exterior surface of the pipe and the interior surface of the sleeve shall be firmly packed with mineral wool insulation and caulk at

both ends with plastic waterproof cement which will dry to a firm but pliable mass, or with a segmented elastomeric seal. Where pipes pass through fire walls or fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07840A FIRESTOPPING. Sleeves in masonry and concrete walls, ceiling, roofs and floors shall be hot-dip galvanized steel, ductile-iron, or cast-iron. Other sleeves shall be galvanized steel sheet pipe not less than 4.4 kg per square meter .

2.17 ESCUTCHEON (WALL) PLATES

Escutcheon plates shall be one-piece or split-hinge type metal plates and shall be provided for piping passing through floors, walls, and ceiling in exposed areas. In finished areas, plates shall be polished stainless steel or chromium-plated finish on copper alloy. In unfinished areas, plates shall have painted finish. Plates shall be secured in position.

2.18 DISINFECTING MATERIALS

2.18.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.18.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.19 **PRESSURE GAUGES**

***2**
Provide liquid filled 90 mm face gauges with a range to provide an accurate reading with 1%.

PART 3 EXECUTION

3.1 FIRE PUMP INSTALLATION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation the fire pump(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the fire pump installation periodically assure that the installation conforms to the contract requirements. The Fire Protection Specialist shall perform a thorough inspection of the fire pump installation, including visual observation of the pump while running shall be conducted. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION REQUIREMENTS

Installation, workmanship, fabrication, assembly, erection, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.

3.4.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.2 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D 3308 and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm .

3.4.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters intervals.

3.4.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (METERS)

Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Copper Tube	1.8	2	2.4							
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

3.4.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation per NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 900 mm .

3.4.5 Grooved Mechanical Joint

Grooves shall be prepared according to the couping manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 16415A ELECTRICAL WORK, INTERIOR.

3.6 PIPE COLOR AND MARKING

Paint all exposed interior piping (color will be the same as the walls and or ceiling, or a complementing color). Do not paint exposed interior fire protection piping red. Exposed piping in the fire protection equipment room and mechanical rooms may be left unpainted. Stainless steel piping may be cleaned and left unpainted.

Mark all exposed interior piping, at 8-meter intervals, with plastic wraparound-type pipe labels conforming to ASME/ANSI A13.1 indicating the type of fluid carried and direction of flow. Labels are not required on sprinkler system branch lines and pipes less than 51 millimeters in nominal size. The following legends are required:

Fire Protection Water - Used on dedicated potable and non-potable fire protection water supply lines.

Foam Concentrate - Used on high expansion foam concentrate lines.

Fire Sprinkler or Sprinkler Fire - Used on standard water-only sprinkler systems.

High Expansion Foam - Used on lines supplying low-level high-expansion foam generators.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at 120 percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at 120 percent of their rated capacities. The new pumps may be used to attain the required flushing volume. Flushing operations shall continue until water is clear, but not less than 10 minutes. The Contractor shall submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 1551 kPa for a period of 2-hours, or at least 345 kPa in excess of the maximum pressure, when the maximum pressure in the system is in excess of 1207 kPa .

3.8.2 Preliminary Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated.

3.8.3 Final Acceptance Test

The Fire Protection Specialist shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) shall also witness for the final tests. The Contractor shall be responsible for repairing any damage caused by hose streams or other aspects of the test. The final acceptance test shall include the following:

3.8.3.1 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part

of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 149 kW shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.8.3.4 Alarms

All pump alarms, both local and remote, shall be tested.

3.8.3.5 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.4 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, the Contractor shall performed corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.5 Test Equipment

The Contractor shall provide all equipment and instruments necessary to conduct a complete final test, including 65 mm diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. The Government will furnish water for the tests.

3.8.6 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic test(s) are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 FIELD TRAINING

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the fire pump installation is functionally complete but prior to the start tests specified herein. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 13930A

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME/ANSI A13.1	(1996) Scheme for the Identification of Piping SystemsRef Title

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 135	(2001) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 449	(2000) Quenched and Tempered Steel Bolts and Studs
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999el) Ductile Iron Castings
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 563M	(2000) Carbon and Alloy Steel Nuts (Metric)
ASTM A 795	(2000) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)

ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM F 436	(2000) Hardened Steel Washers
ASTM F 436M	(1993) Hardened Steel Washers (Metric)
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015	(1999) Double Check Backflow Prevention Assembly

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1997; Addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(1998) Approval Guide Fire Protection
FM P7825b	(1998) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 13R	(1999) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 1963	(1998) Fire Hose Connections
NFPA 230	(1999) Fire Protection of Storage
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(1995) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 668	(1995; Rev thru Dec 1998) Hose Valves for Fire Protection Service
UL Bld Mat Dir	(1999) Building Materials Directory
UL Fire Prot Dir	(1999) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Rack sprinklers shall be in accordance with NFPA 230. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

***2**
The system shall be hydraulically designed to discharge a minimum density as indicated on the drawings. The minimum pipe size for branch lines in gridded systems shall be 32 mm . Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s. **Ensure underground mains are adequately sized so that maximum flow velocity does not exceed 3 meters per second.**

1.2.1.1 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 1254 kPa, and a flow of 9462.5 Lpm at a residual pressure of 896 kPa. Water supply shall be presumed available at the fire pump. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping. Hydraulic calculations shall be based on operation of the fire pump(s) provided in Section 13920A FIRE PUMPS

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed 12.1 square meters.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature

variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES::

SD-02 Shop Drawings

Sprinkler System Shop Drawings; G, ED .

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

***2 f. The Contractor shall submit the detailed plans, schedule,**

procedure, manpower requirement, and equipment necessary for the final test to the contracting officer 60 days prior to the final test for approval.

As-Built Shop Drawings; G, ED

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals; G, ED.

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Materials and Equipment; G, ED.

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G, ED.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts; G, ED.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

***2 Calibration Certificate; G**

All testing equipment shall be calibrated by a certified testing laboratory within the 6 month period prior to the test. Calibration certification shall be provided at the time of testing for all testing equipment.

Preliminary Tests Procedures; G, ED.

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

Final Acceptance Test Procedures; G, ED.

Proposed procedures for Final Acceptance Test, no later than 14

days prior to the proposed start of the tests.

On-site Training Schedule; G, ED.

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Preliminary Tests; G, ED.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Test; G, ED.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Fire Protection Specialist Qualifications; G, ED.

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer Qualifications; G, ED.

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Tests; G, ED.

Three copies of the completed Preliminary Tests Reports, no later that 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G, ED.

Three copies of the completed Final Acceptance Tests Reports, no later that 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Fire Protection Specialist Inspection; G, ED.

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including

signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Wet Pipe Sprinkler System; G, ED.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

***2**

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner

intended for a period of not less than 6 months. **Prepare detailed working drawings that are signed and stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.**

1.9 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 150 mm above the floor to a point 1500 mm outside the building wall shall be ductile iron with a rated working pressure of 1207 kPa conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510A WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be

used. Gaskets for ductile iron pipe joints shall conform to AWWA C111.

2.4.3 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm above finished grade. Gate valves and indicator posts shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel .

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer;segmented welded fittings shall not be used. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type.

2.5.1.5 Bolts, Nut, and Washers

Bolts shall be square head conforming to ASME B18.2.1 and shall extend no less than three full threads beyond the nut with bolts tightened to the

required torque. Nuts shall be hexagon type conforming to ASME B18.2.2. Washers shall meet the requirements of ASTM F 436M . Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.3 Valves

2.5.3.1 Control Valve and Gate Valve

***2**
Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. **All control valves and gate valves require electronic tamper supervision.**

2.5.3.2 Check Valve

Check valve 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.6 AUTOMATIC WATER CONTROL VALVE ASSEMBLY

Assembly shall include an automatic water control (externally resettable) valve, standard trim piping, pressure gauges, bypass, testing valves, main drain, and other components as required for a fully operational system.

2.7 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

2.8 ALARM INITIATING AND SUPERVISORY DEVICES

2.8.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.8.2 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 15 mm NPT male pipe thread. The switch shall have a maximum service pressure rating of 1207 kPa. There shall be two SPDT (Form C) contacts factory adjusted to operate at 28 to 55 kPa. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

2.8.3 Valve Supervisory (Tamper) Switch

***2**

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem **and contain 2 SPDT (Form C) contacts.**

2.9 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963 .

2.10 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be intermediate. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Orifice of extended coverage sprinklers shall not exceed 13.5 mm .

2.10.1 Recessed Sprinkler

Upright sprinkler shall be chrome-plated quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.10.2 Upright Sprinkler

Upright sprinkler shall be brass quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.11 DISINFECTING MATERIALS

2.11.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.11.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.12 ACCESSORIES

2.12.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.12.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.12.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.12.4 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.13 Surge Arrester

***2**
Provide surge arrester not less than 38 liter for each wet pipe riser above the riser check valve. Arrester shall be listed (approved with a working pressure not less than 1895 kPa.

2.14 Pressure Gauges

***2**
Provide liquid filled 90 mm face gauges with a range to provide an accurate reading within 1%.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Installation of in-rack sprinklers shall comply with applicable provisions of NFPA 230.

3.3 FIRE PROTECTION SPECIALIST INSPECTION

The Fire Protection Specialist shall inspect the sprinkler system

periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm . Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm . Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools shall be products of the same manufacturer. For copper tubing, pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840A FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected at the riser as a combination test and drain valve; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.4.11 Drains

Main drain piping shall be provided to discharge in an adequately sized sanitary drain. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 11 liters, the auxiliary drain shall consist of a valve not smaller than 15 mm and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 11 liters, the auxiliary drain shall consist of two 25 mm valves and one 50 x 300 mm condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 25 mm in diameter. Tie-in drain lines shall be pitched a minimum of 15 mm per 3 mm.

3.4.12 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm above finished grade . The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 900 mm. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm outside the building walls shall meet the requirements of Section 02510A WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.7 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851A FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.8 DISINFECTION

After all system components are installed and hydrostatic test(s) are successfully completed, each portion of the sprinkler system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. Flushing shall be conducted by removing the flushing fitting of the cross mains and of the grid branch lines, and then back-flushing through the sprinkler main drains. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. After successful completion, verify installation of all sprinklers and plugs and pressure test the system.

3.9 PIPE COLOR AND MARKING

Paint all exposed interior piping (color will be the same as the walls and or ceiling, or a complementing color). Do not paint exposed interior fire protection piping red. Exposed piping in the fire protection equipment room and mechanical rooms may be left unpainted. Stainless steel piping may be cleaned and left unpainted.

Mark all exposed interior piping, at 8 meter intervals, with plastic wraparound type pipe labels conforming to ASME/ANSI A13.1 indicating the type of fluid carried and direction of flow. Labels are not required on sprinkler system branch lines and pipes less than 51 mm in nominal size. The following legends are required:.

Fire Protection Water - Used on dedicated potable and non-potable fire protection water supply lines.

Foam Concentrate - Used on high-expansion foam concentrate lines.

Fire Sprinkler or Sprinkler Fire - Used on standard water only sprinkler systems.

High Expansion Foam - Used on lines supplying low level high expansion foam generators.

3.10 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.10.1 Underground Piping

3.10.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.10.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters per hour per 100 gaskets or joints, regardless of pipe diameter.

3.10.2 Aboveground Piping

3.10.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.10.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.10.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph

SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.11 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

3.12 ON-SITE TRAINING SCHEDULE

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions for wet pipe sprinkler system.

-- End of Section --

SECTION 13991
HIGH EXPANSION FOAM (HEF) FIRE PROTECTION & FIRE ALARM SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Provide high expansion foam (HEF) system to protect all areas of the aircraft servicing area hangar bays as shown on the drawings.

1. HEF system design is based on the system and products available from the Ansul Corporation (Marinette, WI), as specified herein.

a. Provide two minimum 1514 L and one 1135 L HEF diaphragm tanks and proportioning systems with HEF concentrate for initial tank filling, testing, and refilling at the conclusion of final acceptance testing. A reserve supply of HEF concentrate is not required.
b. Provide a single HEF system riser with valves and appurtenances as shown on the Drawings.
c. Provide a single HEF system riser with valves and appurtenances as shown on the Drawings.
d. Provide HEF generators, mounted and supported as shown on the Drawings.
e. Base design for system discharge rate and capacity on ETL 01-2 as follows:
    1. Low-level high-expansion foam systems shall cover 90 percent of the aircraft silhouette area projected on the floor in one minute or less.
    2. Low-level high-expansion foam systems shall cover the aircraft servicing area and adjacent accessible areas to a depth of one-meter in four minutes or less.
    3. The available concentrate and water supply shall provide for generation of four times the submergence volume but no less than a 15-minute period of continuous operation.

B. Provide a complete foam system control system, including the following.

1. A hard wired Foam System Control Panel (FSCP) which is UL listed for releasing service and arranged to monitor and control all HEF system components.
2. Linear thermistor type heat detectors throughout the hangar bays as indicated.
3. Alarm and supervisory pressure switches.
4. Solenoid valves and other actuators required for system operation.
5. Separate manual pull stations arranged to discharge the HEF system.
6. Separate horn/strobe notification appliances to indicate HEF system discharge.
7. Valve tamper switches for all water, concentrate and foam/water mixture control valves.
8. Output contacts for Alarm, Supervisory and Trouble conditions for monitoring by the Building and Base Fire Alarm Systems.

C. Provide a separate transceiver Monaco BT-16 with a frequency at 138.925 MHz.

D. Test the HEF system.

E. Provide an Operation and Maintenance Manual.

F. Provide record drawings.

G. Train Government personnel in the operation and maintenance of the systems.

H. All other components, programming and arrangements required for a complete and functional system in accordance with the referenced codes and standards.

1.2 CODES AND STANDARDS

A. The publications listed below form a part of this specification. The publications are referred to in the text by the basic designation only. Except as modified by these specifications, all work shall conform to the requirements of the following codes and standards:

1. NFPA 11A-1999 Edition, Standard for Medium – and High – Expansion Foam Systems.
2. NFPA 13-1999 Edition, Standard for the Installation of Sprinkler Systems (as referenced by NFPA 11A).
3. NFPA 70-1999 Edition, National Electrical Code.
4. NFPA 72-1999 Edition, National Fire Alarm Code.
5. USAF ETL 01-2 April 2001, Fire Protection Engineering Criteria-New Aircraft Facilities.
6. MIL-HDBK-1008C

B. If there is a conflict between the referenced codes or standards and this specification, it shall be the CONTRACTOR'S responsibility to bring the conflict to the attention of the CONTRACTING OFFICER in writing for resolution. The more stringent requirement, as determined by the CONTRACTING OFFICER, shall apply.

C. Applicable Publications:

1. Factory Mutual Approved Guide (Equipment, Materials, Services for Conservation of Property) 2000, with Quarterly Supplements.
2. Underwriters' Laboratories, Inc. (UL) publication: Fire Protection Equipment Directory (Jan 2000 with Quarterly Supplements).

1.3 QUALIFICATIONS

A. The CONTRACTOR shall have successfully installed HEF fire suppression systems, and fire alarm systems, or the CONTRACTOR shall have a contractual agreement with a Subcontractor having such required experience.

B. Names of projects, locations, and telephone numbers of persons to contact shall be provided for at least two installations where the CONTRACTOR or his Subcontractor has installed HEF extinguishing systems and detection and alarm systems.

***2** C. Shop drawings and calculations shall be prepared by, or under the direct supervision of registered professional engineer who is regularly engaged in design of fire protection systems. Qualifications with license number shall be submitted to and approved by the CONTRACTING OFFICER prior to submission of the show drawings. **Prepare detailed working drawings that are signed and stamped by a Registered Professional Engineer practicing in the field of Fire Protection Engineering.**

1.4 STANDARD PRODUCTS

A. Material and equipment shall be standard products of their respective manufacturers, and shall be of a model, which has been in production for not less than 3 years. Equipment shall be supported by a service organization that is, in the opinion of the CONTRACTING OFFICER, reasonably convenient to the site.

1.5 NAMEPLATES

A. All system equipment shall have the manufacturer's name, address, type or style, and catalog number on a non-corrosive, non-heat sensitive plate securely attached to the equipment.

1.6 VERIFICATION OF DIMENSIONS

A. The CONTRACTOR shall become familiar with all details of the work, verify all dimensions in the field, and shall revise all pipe, conduit and equipment locations to avoid obstructions and allow installation of new equipment.

1.7 QUALITY ASSURANCE

A. The CONTRACTOR shall show, to the satisfaction of the CONTRACTING OFFICER, that the control equipment, control equipment modules, detectors, signaling devices, releasing devices, and manual HEF discharge stations are electrically compatible and either are the standard product of a single manufacturer, or cross-listed for use with one another. Any components determined by the CONTRACTING OFFICER or by system testing or by operational experience to be either incompatible or non-listed for use with one another shall be replaced with equipment or components which are compatible at no additional cost to the government.

B. Manufacturer's representatives shall supervise the final testing of equipment. Manufacturer's representatives shall have a minimum of 1 year of experience in testing or installation of the equipment. The CONTRACTOR shall provide the services of manufacturer's representatives for the following work:

1. HEF releasing panel installation and testing.
2. High expansion foam diaphragm tank and foam generator equipment installation, filling and testing.

C. The CONTRACTOR shall warrantee all work for a period of 1 year from the date of successful acceptance testing.

*2 **D. The Contractor shall submit the detailed plans, schedule, procedure, manpower requirements, and equipment necessary for the final test to the contracting officer 60 days prior to the final test for approval.**

1.8 SHOP DRAWINGS

A. The CONTRACTOR shall submit six full sets of shop drawings which shall include a complete list of equipment and materials, including product data sheets as specified below.

B. The CONTRACTOR shall not begin system installation prior to receiving written approval of shop drawings from the CONTRACTING OFFICER or his designated representative.

C. Only complete submittals containing all required information for all work required in this section will be reviewed. Incomplete submittals will be returned to the CONTRACTOR without being reviewed. The submittals shall identify the timing or phasing of all aspects of the work, and how the work will be coordinated with other renovation and construction required for the project.

D. The complete show drawing submittals shall include any additional information necessary for installation of the system, including copies of all cross-referenced drawings and documents.

E. All Drawings and diagrams shall be prepared on drawing sheets of uniform size, 1189 x 841 mm minimum, and shall contain no extraneous information. All other information required for this submittal shall be submitted in one or more appropriately labeled (i.e., CONTRACTOR'S name, project, submittal name/description and date) and indexed 3-ring binders.

F. All Drawings and diagrams shall include the CONTRACTOR'S title block, complete with drawing title, CONTRACTOR'S name, address, date including revisions, and preparer's and reviewers initials.

G. Floor plan drawings required for this submittal may be generated using the bid drawings as backgrounds.

H. All Drawings and diagrams shall be sufficiently clear to allow legible 1189 x 841 mm reproductions. Upon approval of the shop drawing submittal, including any required revisions, CONTRACTOR shall provide one complete, reproducible (Mylar) set of 1189 x 841 mm drawings and diagrams for the Government's use in performing field observations during construction.

I. The shop drawing submittal shall include:

1. A complete equipment list identifying quantities and manufacture's model numbers. This list shall include catalog data sheets for each item including:
   a. Pipe.

b. Pipe fittings/joining methods.
c. Hangers.
d. Valves.
e. Basket strainer.
f. Deluge valves.
g. Fire department connection.
h. Test header.
i. HEF diaphragm tank.
j. HEF proportioner.
k. HEF concentrate.
l. Automated HEF concentrate control valve.
m. Foam System Control Panel (FSCP).
n. Base fire alarm transceiver.
o. Manual HEF discharge stations (with covers and signage).
p. Heat detectors.
q. Power supplies.
r. Surge arresters.
s. Batteries.
t. Wire (with samples of each type).
u. Conduit.

2. A drawing legend sheet identifying:
   a. All symbols used on the drawings, by type of device or equipment, manufacturer and manufacturer's part number. This information shall correspond to the manufacturer's catalog data sheets and installation manuals.
   b. All conventions, abbreviations and specialized terminology used on the drawings, as necessary to understand and interpret the information contained therein.
   c. All color codes and conduit, conductor/circuit and device number systems.
   d. A complete drawing list identifying all drawings in the shop drawing package by title, drawing number and Specification cross reference.

3. Single line or architectural floor plan drawings, drawn to 1 to 100 mm scale or larger (i.e., 1 to 50 mm, etc.), showing:
   a. North arrow.
   b. Graphical scale indicator.
   c. Drawing keyplan (if there are multiple drawings per floor).
   d. Use of occupancy of each room or area (i.e., office, mechanical room, storage, etc.).
   e. Locations of all fire protection devices, equipment, risers and electrical power connections, including breaker number(s).
   f. Point-to-point, actual conduit and circuit routing, identifying number, size and type of conduits and conductors. This information shall be depicted in sufficient detail to readily locate specific conduits and circuits in the field and to identify the specific conductors/circuits contained therein. All penetrations of fire-rated barriers shall be individually noted.

g. Conduit fill calculations, in chart form, indicating the cross-section area percent fill for each type of wire/cable in each size of conduit used in the system.

4. Working plans for the hydraulically designed HEF systems showing all of the information required by NFPA 11 and 13 including drawings showing construction and location of all equipment, controls, foam generators, piping, valves, drains, sway bracing, location and diameter of all pipe penetrations, pipe sleeves and pipe clearance openings.
5. Detail Drawings Depicting:
   a. Valve trim arrangement of the deluge valves. The trim shall be drawing in sufficient detail to illustrate proper installation of all components.
   b. Mounting of deluge valves, feed piping and risers.
   c. Piping arrangement of the HEF diaphragm tank proportioning system, with tank connections and trim, valves, sensing lines, gauges, relief valves, HEF proportioner and concentrate lines.
   d. Detailed pipe supporting and restraining methods proposed for the risers, feed mains, proportioning equipment, drains and test connections.

1.9 HYDRAULIC INFORMATION

A. A new 157.7 LPs electric motor driven primary and secondary fire pump will be installed as part of this project Specification Section 13920A. The pump shall be rated at a minimum 896 kPa with final required pressure as determined by the pressure requirement for the foam generators and the supply piping. This requirement requires coordination with general contractor to ensure a complete and finished product is delivered to the government.

*2 **B. The system shall be hydraulically designed to provide the manufactures required discharge. Water velocity in piping shall not exceed 6 meters per second. Ensure underground mains are adequately sized so that maximum flow velocity does not exceed 3 meters per second.**

1.10 CATALOG DATA SHEETS

A. Where manufacturer’s catalog data sheets or installation manuals/instructions show or describe more than one product or products not relevant to the project, they shall be marked up with arrows or other suitable means and cross-referenced as necessary to clearly identify both the product(s) to be provided and the specific information applicable to the proposed product. Catalog information shall not be included for equipment which is not being provided; unedited manufacturer’s catalogs are unacceptable.

1.11 OPERATION AND MAINTENANCE MANUAL

A. The CONTRACTOR shall submit 6 copies of a preliminary Operation and Maintenance Manual, prepared specifically for this project and bound in an indexed 3-ring binder, containing:

1. Complete manufacturer’s catalog data sheets and installation manuals/instructions for all devices and equipment proposed, as packaged with the equipment from the manufacturer, and any supplementary system manuals,

product bulletins and engineering technical letters available from the system manufacturer to installers of the system manufacturer's equipment. Photocopies are not acceptable. This portion of the submittal shall be provided in a labeled, 3-ring binder, indexed by manufacturer and type of device.

2. A detailed narrative description of the system architecture, inputs, auxiliary functions, suppression system releasing, annunciation, intended sequence of operations, expansion capability, application considerations and limitations.
3. Operator instructions for basic system operations including alarm acknowledgement, system shutdown, system reset, operation of controls, isolation of components for servicing, etc.
4. A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including a testing and maintenance schedule and detailed testing and maintenance instructions for each type of device installed. This information shall include:
   a. A listing of the individual system components which require periodic testing and maintenance.
   b. Step-by-step instructions detailing the requisite testing and maintenance procedures and the intervals at which those procedures should be performed, for each type of device installed.
   c. A schedule which correlates the testing and maintenance procedures with the list of individual components. This schedule shall be completed for the duration of the warranty period or for one complete testing/maintenance cycle, whichever is longer.
5. A list of recommended spare parts, including current unit prices (delivered costs), as necessary to maintain the system in operation on a continuous basis.
6. A service director, including a list of individual's names and telephone numbers to obtain service on the system, including emergency service as required elsewhere in these Specifications.
7. Half scale drawings showing the location of all control equipment, control panels, valves, and other operating devices. This shall be required for the final submittal of the manual only.

B. The preliminary manual will be reviewed for required content and approved or disapproved on that basis. Upon completion of the project, the CONTRACTOR shall revise the approved, preliminary manual to be consistent with the system as installed and specifically to coordinate the testing and maintenance schedule with the approved CONTRACTOR testing protocols and with the fire protection device numbers indicated on the CONTRACTOR'S record drawings.

C. The revised manual shall constitute the basis for the Training Sessions required elsewhere in this specification.

D. Six copies of the final Operation and Maintenance Manuals shall be submitted and approved prior to the training sessions.

E. This manual shall be produced specifically for this project and the system installed. Unedited manufacturer's catalog data sheets and/or equipment manuals are unacceptable as content for this submittal.

1.12 RECORD DRAWINGS

A. The CONTRACTOR shall maintain on site a separate set of approved shop drawings for the overall system, marked in red, to indicate all deviations from the shop drawings to indicate as-built conditions.

B. These drawings shall be maintained in a current condition at all times and shall be made available for review immediately upon request during normal working hours.

C. All variations from the approved shop drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials and/or required coordination between trades, shall be indicated in sufficient detail to accurately reflect the as-built conditions.

D. The record drawings shall include all information required for the shop drawings as specified above.

E. Upon approval of the record drawing submittal, before either final payment or acceptance of the project by the CONTRACTING OFFICER, provide plasticized half-scale copies of all detailed wiring diagrams required for the shop drawing submittal, updated to reflect as-built conditions.

1. One plasticized, half-scale copy shall be attached to the inside of the door of its associated control cabinet or electrical enclosure and one copy shall be included in each Operation and Maintenance Manual.
2. Where attachment of these diagrams within their associated control cabinet or electrical enclosure shall obstruct controls or indicators, or prevent or inhibit access to the equipment, the diagrams shall be framed behind clear acrylic, 3 mm thick minimum, and solidly mounted adjacent to the associated equipment.

F. The record drawing shall be reproducible, and shall be submitted to the CONTRACTING OFFICER with 6 sets of blueline copies and one CD containing electronic drawings in AutoCAD 2000 format within 10 working days after successful completion of final acceptance testing.

1.13 EMERGENCY SERVICES

A. The CONTRACTOR shall provide emergency repair service for the systems at not cost to the Government, within 48 hours of a request for such service by the Government during both the installation and the warranty periods. This service shall be provided on a 24 hours per day, 7-day per week basis.

1.14 COORIDINATION

A. The CONTRACTOR is responsible for the coordination of trades to ensure a complete and finished product is delivered to the government.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

***2** A. Piping which contains water or high expansion foam (HEF) solution, shall be Schedule 40 black steel pipe meeting either ASTM A53 or ASTM A135 requirements with threaded, flanged, or **grooved** ~~or shop-welded~~ fittings. Fittings shall be cast iron or malleable iron. Fittings and flanges shall be rated at not less than 1200 kPa.

1. Schedule 10, Schedule 40 "replacement," and other piping systems will not be accepted.
2. Galvanized piping is specifically prohibited.
3. Pipe sizes 200 mm and larger may be Schedule 30 in lieu of Schedule 40.
4. Cut groove, mechanical couplings, shall be rated at a minimum of 1725 kPa. All mechanical couplings provided shall be the product of a single manufacturer. All fasteners, parts and materials used shall be the product of the coupling manufacturer, specifically intended by the manufacturer for installation with the coupling.
5. Trim piping provided with deluge valves shall be the standard components provided by the valve manufacturers. If the standard trim includes galvanized components, black steel or brass components shall be provided instead.
6. Fitting for reductions in pipe size shall have tapered reducing waterway. Reducing fittings which have abrupt changes in waterway size are not acceptable.

***2** B.

1. Piping which contains HEF concentrate shall be Schedule 40, 304 series stainless steel pipe with grooved, flanged or **grooved** ~~or shop-welded~~ fittings.. Fittings shall be 304 series stainless steel. Fittings and flanges shall be rated at not less than 1200 kPa.

2.2 PIPE HANGERS

A. Hangers shall be in accordance with NFPA 13.

B. Hangers and accessories shall be galvanized steel.

2.3 VALVES

A. Valves in Contact with Water or HEF Solution.

1. All valves shall be UL listed for FM approved for their intended use.
2. Valves shall be of cast iron construction and shall be rated for a working pressure of not less than 1200 kPa.
3. OS&Y valves shall be UL listed. Butterfly valves shall not be accepted as a substitution where OS&Y valves are indicated.
4. Valves indicated as supervised shall be provided with a UL listed valve supervisory switch, connected to the fire alarm system.
5. Hose valves shall be all brass or bronze, gate valve type straightway pattern.

***2 B. The pressure ratings of all valves shall meet or exceed maximum working pressure available within the system and contain two (2) sets of SPDT (Form C) contacts.**

2.4 STRAINERS

A. Basket Strainer:
1. Basket strainer shall have cast iron flanged body and cover flange rated for 1200 kPa.
2. Strainer basket shall be formed of perforated stainless steel sheet with 6.4 mm perforations. Basket shall have a minimum 50 percent open area.
3. Pressure drop due to friction of flow through the basket strainer shall not exceed 41.4 kPa at a flow rate of 1,500 gpm when the strainer is 50 percent clogged.

2.5 PRESSURE GAUGES FOR WATER OR HEF SOLUTION

A. The pressure gauges shall be installed as indicated on the Drawings and at each deluge valve as part of the standard valve trim.

B. The gauges shall have a range of 0 to 2070 kPa.

C. The dial size shall be 89 mm in diameter, minimum. The dial shall be white with black graduations and numerals.

D. Gauges shall be provided with shock isolators.

2.6 HEF CONCENTRATE

A. High expansion foam concentrate shall be an UL listed high expansion foam concentrate for 2.75 percent proportioning.

B. High expansion foam concentrate shall be the product of the manufacturer of the HEF equipment.

2.7 HEF DIAPHRAGM TANK BALANCED PRESSURE PROPORTIONING SYSTEM

A. HEF concentrate proportioning means shall be a balanced pressure proportioning system utilizing a pressure proportioning diaphragm tank meeting the requirements of NFPA 11A and shall consist of the following:

1. HEF diaphragm storage tank shall be a Plastic or fiber-glass pressure vessel with a full diaphragm (bladder) within the vessel. The tank shall be rated for 1200 kPa working pressure.
2. The diaphragm shall be nylon reinforced rubber conforming to the inside shape of the tank. HEF concentrate shall be stored inside the diaphragm and the concentrate shall not be in contact with the tank. The tank shall have perforated PVC tubes installed inside to assure full displacement of the stored concentrate.
3. The tank shall be equipped with all the manufacturer’s standard fittings and trim including HEF fill and drain connections, water fill and drain connections, water and HEF pressure relief valves, water and HEF pressure gauges, HEF site gauge and strainer on the tanks water inlet.

4. The tanks shall be a horizontal type with two rated for a minimum of 1514 L and one rated for a minimum 1135 L of foam concentrate and mounted on steel saddles suitable for direct mounting on a concrete floor. The CONTRACTOR shall fill the tank with HEF 2.75 percent concentrate to its full capacity prior to system testing and shall refill the tank to full capacity upon the successful completion of all required testing. The CONTRACTOR shall provide filling and draining instructions mounted under Plexiglas where directed by the CONTRACTING OFFICER.
5. The filling of the diaphragm with HEF concentrate shall be performed by and/or directly supervised by a qualified representative of the manufacturer or supplier of the diaphragm tank. A qualified representative shall have at least 1 year of experience in service or installation of HEF diaphragm tanks.
6. The HEF proportioners shall be the product of the manufacturer of the HEF diaphragm storage tank. It shall be flanged at both ends, or of the between the flanges type. The HEF proportioners' size shall be no larger than 150 mm. Unit shall be UL listed, and/or FM approved.

2.8 FOAM GENERATORS

A. The high expansion foam generators shall be powered by a water reaction motor. The water reaction motor shall provide both the screens wetting solution and the energy to drive the fan. The foam generators shall not require any outside power source.

B. The screens shall be of stainless steel construction.

C. The high expansion foam generators shall be UL listed and/or FM approved.

D. The high expansion foam generators shall have the capacity shown on the Drawings as a minimum.

2.9 AUTOMATED HEF CONCENTRATE VALVES

A. Automated HEF concentrate valves shall be either hydraulically controlled ball valves. All automated HEF concentrate valves provided shall be of the same type.

1. Hydraulically controlled ball valve shall be a full port, 6.4 mm turn ball valve, or the same nominal size as the connecting HEF concentrate piping.
2. The valve body shall be bronze or stainless steel. The valve ball shall be stainless steel.
3. The valve shall be provided with a hydraulic actuator, designed for ON/OFF operation of 6.4 mm turn ball valves. The actuator cylinder shall be designed for operation by water pressure, and shall be rated for not less than 83 kPa of water pressure.
4. The valve shall be in the closed position until the HEF system is operated. Water pressure to the actuator shall be provided from the alarm line of the deluge valve, as indicated on the Drawings.
5. A means of disengaging the cylinder, or releasing its water pressure, for manually overriding the valve shall be provided.
6. The valve shall have an external mechanical position indicator.

2.10 FOAM SYSTEM CONTROL

A. Foam System Control Panel (FSCP) shall be provided. The FSCP shall be compatible and listed for use with building Fire Alarm Control Panel (FACP) and shall be connected to operate as a complete system. The CONTRACTOR is responsible for the coordination to ensure monitoring of the FSCP alarm contacts by the FACP. The system shall provide operating and supervisory functions as specified.

B. All fire alarm system control equipment shall be of modular construction to facilitate system expansion and servicing.

C. All FSCP equipment shall be housed in locking metal NEMA 4x or manufacturers equivalent humidity resistant enclosures. All manual controls shall be behind locked cabinet doors or key operated, or both. All locks shall be keyed alike.

D. The panels shall have prominent engraved plastic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches.

E. All circuits shall be installed as non-power limited fire protective signaling circuits as defined by the National Electrical Code.

F. All initiating circuits shall be Class A, Style D as defined by NFPA 72.

G. All notification circuits shall be Class A, Style Z as defined by NFPA 72.

H. All releasing circuits (for solenoids) shall be “Class B” two-wire circuits as defined by NFPA 72.

I. The FSCP shall contain a disconnect switch for each individual releasing zone. Deactivating any releasing zone shall cause a trouble condition.

J. The system shall have output contacts to transmit all alarm, supervisory and trouble conditions to the fire alarm control panel/radio transceiver. The system shall have output contacts to transmit fire alarm conditions to the local building panel in order to initiate building evacuation.

K. The system shall have output contacts to automatically start the fire pump for the hangar.

2.11 FIRE ALARM CONTROL PANEL (FACP)/RADIO TRANSEIVER

A. A base fire alarm system radio transceiver shall be provided. The installation shall include all programming and testing of the local panel and the base fire alarm system to provide for a complete and functional arrangement.

B. The transceiver shall transmit all zones and conditions annunciated on the FSCP to the base fire alarm system.

C. The unit shall be a Monaco BT-16 with a frequency of 138.925 MHz.

D. All fire alarm system control equipment shall be of modular construction to facilitate system expansion and servicing.

E. All equipment shall be housed in locking metal NEMA 4x or manufacturers equivalent humidity resistant enclosures. All manual controls shall be behind locked cabinet doors or key operated, or both. All locks shall be keyed alike.

F. The panels shall have prominent engraved plastic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches.

G. All circuits shall be installed as non-power limited fire protective signaling circuits as defined by the National Electrical Code.

H. All circuits monitoring the FSCP shall be Class A, either Style 7 or Style D, as defined by NFPA 72.

2.12 POWER SUPPLIES

A. Each panel shall be provided with ac power via a hardwired dedicated circuits. Each ac power circuit shall be provided with a single, approved disconnecting means between the service entrance and panel, and shall, along with all associated connections, be installed entirely within approved electrical enclosures of conduits. The power circuit disconnecting means shall be clearly labeled “Foam System Control Power” and “Fire Alarm Control Panel” and shall be locked.

B. Each panel shall be capable of operating on standby (rechargeable) battery power.

C. Upon failure of normal (ac) power, the affected portion(s) of the systems shall automatically switch over to battery power without disruption of normal system annunciation or operation.

2.13 MANUAL HEF DISCHARGE STATIONS

A. Manual HEF discharge stations shall be provided at locations shown on the Drawings.

B. Manual HEF discharge stations shall be UL listed manual fire alarm stations of the double action type. Stations shall be metallic construction. Stations shall not be of the break glass (or plastic) type. Manual HEF discharge stations shall not be the same device as used for the manual fire alarm stations.

C. Manual HEF discharge stations shall require a key for reset. The key will match the key for the FACP and FSCP panels.

D. Manual HEF discharge stations shall be surface or semi-flush mounted, using weatherproof backboxes and appropriate mounting hardware, on walls or columns,1220 to 1370 mm from the floor to the top of the station.

E. Stations shall have a lime-yellow finish, with lettering which reads, “Foam Discharge,” or similar.

F. Manual HEF discharge stations shall be mounted with hinged clear lexan plastic covers, which must be lifted prior to activating the station.

2.14 VALVE SUPERVISORY (TAMPER) SWITCHES

A. Valve supervisory switches shall be installed on all valves controlling the water supply, the HEF concentrate supply, and the HEF solution.

B. Valve supervisory switches shall be appropriate for the type of valve on which they are installed, shall be installed in accordance with the manufacturer's installation instructions, and shall have metal housings. Switches shall be UL listed or FM approved.

2.15 HEAT DETECTORS

A. Heat detectors shall be installed at the underside of the roof of the aircraft servicing area to activate pre-action suppression systems.

B. Linear thermistor fire detector having a temperature rating between 71 °C and 76 °C. Maximum spacing between detectors is 12 meters, or the detectors' listed spacing, whichever is less. Actual spacing shall be in accordance with NFPA 72 and shall incorporate consideration of building structural features.

2.16 WIRING AND GROUT

A. All low voltage wiring shall be solid copper or bunch tinned (bonded) stranded copper, number 14 AWG size, minimum, and shall meet of NEC Article 760 for non-power limited service.

B. All ac power wiring shall be solid copper, bunch tined (bonded) stranded copper or stranded copper, number 12 AWG size, minimum.

C. All wiring shall be insulated for 600 volts (except bare shield drain conductors); insulation type per NEC Article 760 for non-power limited circuits.

D. The use of aluminum wire is prohibited.

E. Conduit shall be UL EMT with compression type fittings, minimum 19 mm size.

F. Flexible conduit used for whips to devices shall be UL listed, minimum 19 mm size, liquid-tight, flexible metallic conduit, 18.30 mm maximum length.

2.17 SPECIAL TOOLS AND SPARE PARTS

A. Special tools necessary for the maintenance of the equipment shall be furnished and be turned over to the CONTRACTING OFFICER.

*** 2 2.18 TEST HEADER**

A. Provide a test header for all low-level foam systems. Each header must have at least a 2.5 inch nose fittings.

***2 2.19 PRESSURE GAUGES**

A. Provide liquid filled 90 mm face gauges with a range to provide an accurate reading within 1%.

***2 2.20 BALANCED PRESSURE PROPORTIONER (RATIO CONTROLLER)**

A. The proportioner shall be a standard balanced pressure type unit capable of proportioning AEFF liquid at 3 percent, (3 parts concentrate to 97 parts water by volume solution) at flow rates within the flow range of the proportioner. Major components of the proportioner, including the body, inlet nozzle and metering orifice shall be of brass, bronze or stainless steel. The body shall be clearly marked with a flow-direction arrow, and the type and percent of AEFF concentrate that it was designed to proportion. The proportioner size shall be 150 mm and shall have a maximum friction loss of 48 kPa at a flow rate of 5676 L/second. The in-line balanced pressure proportioner shall be an assembly that includes a proportioner as described, integral pressure balancing valve with duplex pressure gauge, inlet pressure gauge and manual ball valve. The proportioner assembly shall be factory assembled and tested as an assembly by one manufacturer. Field disassembly or assembly of any component part will not be accepted. Components shall be of the make/model required by the specific UL listing or PM approval.

PART 3 EXECUTION

3.1 PIPE JOINTS AND FITTINGS

A. Joints shall conform to NFPA 13, and shall be grooved, flanged, threaded or shop welded. No welding or flame cutting shall be permitted in the building.

B. Threaded pipe joints shall be sealed with Teflon tape. The use of “pipe dope” is prohibited.

C. Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of bushings or fittings, which have abrupt changes in waterway size, is prohibited.

***2 3.2 STRAINERS**

A. Provide basket-type strainers upstream of risers on all foam-water systems.

3.3 PIPE PENETRATIONS AND ESCUTCHEONS

A. All pipe penetrations of walls, floors and ceilings shall be sealed (in accordance with Section 07920, SEALANTS AND CAULKING) around the piping by the CONTRACTOR, restoring the walls, floors and ceilings to there indicated fire resistance rating. The CONTRACTOR shall be responsible for all patching and touch-up painting necessitated by the performance of his work.

B. Chrome plated escutcheons shall be provided at all surfaces where exposed piping passes through walls. Escutcheons shall be fastened securely to pipe.

3.4 PIPE HANGERS

A. Hangers and supports shall be adequate to maintain the supported load in proper position under all operating conditions.

B. Hanger rod sizes shall be in accordance with NFPA 13.

C. Hangers and supports shall be spaced not more than 3660 mm apart and shall be located at or near changes in direction of pipelines. Hangers shall not be located more than 1830 mm from any tee or elbow.

D. No piping shall be supported from other piping, from metal stairs, ladders, walkways, metal decks, bridging, bracing or suspended ceilings.

E. Cutting of structural members shall be prohibited.

3.5 SWAY BRACING

A. Sway bracing shall be provided where piping changes direction in accordance with NFPA 13, Section 6-4.5 and Appendix A, paragraph A-6-4.5, and related sections.

3.6 SYSTEM DRAINS

A. All system piping shall be provided with drains in accordance with NFPA 13. The drain valves shall not be installed higher than 2130 mm above the finished floor.

B. Drain valves shall be provided with permanent identifying tags to indicate their associated system.

3.7 IDENTIFICATION

A. Identify piping and equipment throughout with labels and direction of flow arrows. Apply labels at not more than 4570 mm, before and after pipes pass through walls and at intervals closer than 4570 mm in the HEF room as required.

B. Provide 25 mm diameter brass number tags on each control valve with number stamped in black, secured to valve wheel with key chain.

C. A list of zones, noting which devices are connected to each zone, shall be provided on inner surface of the doors of the FACP and FSCP.

3.8 EMI/RF PROTECTION

A. All fire alarm control equipment, devices and wiring shall be protected against unwanted radiated electro-magnetic interference (EMI) and from the affects of audio and radio frequencies (RF) that can cause the transmission of spurious alarms.

B. The system shall be designed and installed so as to be unaffected (with all control cabinet faceplates installed) by the operation of handheld, portable radios of up to 5 watts, or portable cellular telephones of up to 1 watt, within 300 mm of any system component(s).

3.9 OVERVOLTAGE AND SURGE PROTECTION

Equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. Cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.10 FIELD QUALITY CONTROL - TESTING

A. General Requirements:

1. All system testing shall be conducted in accordance with approved test protocols prepared by the CONTRACTOR. Written test protocols including detailed test procedures, documentation sheets and expected test results shall be submitted to the CONTRACTING OFFICER within 60 days of award of contract. Approval by the CONTRACTING OFFICER or his designated representative is required.
2. Upon completion and prior to acceptance of the installation, the CONTRACTOR shall subject the system to all tests required by NFPA 11A, NFPA 13 and NFPA 409, and shall furnish the CONTRACTING OFFICER with a certificate as required thereof.
3. The CONTRACTOR is required to plan and schedule testing to meet all other building requirements. The CONTRACTOR shall schedule the final acceptance tests with the CONTRACTING OFFICER, at least 30 calendar days prior to the start of the final acceptance tests.
4. The CONTRACTOR shall furnish at his expense all materials, equipment, and personnel to conduct the tests including items to gain access, measure, or observe specific operations in the test.

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5. The CONTRACTOR shall clean and restore all systems and areas to normal conditions after completion of tests. The CONTRACTOR shall dispose of the discharged HEF foam by breaking it down with water, and have it removed from Government property to an approved disposal site at CONTRACTOR'S expense. **(Delete last sentence)**
6. Required test shall be scheduled to coincide with work in progress to assure all tests have been completed by the time the project is completed.
7. HEF concentrate tests and alarm and detection tests shall be performed by qualified manufacturer's representatives.
8. The CONTRACTOR shall provide the HEF concentrate for testing. After successful completion of all tests, the CONTRACTOR shall refill the HEF tank to its full capacity with HEF concentrate. The HEF concentrate piping between the tank and the automated HEF concentrate valve shall also be filled with HEF concentrate after the final testing.
9. All final acceptance tests will be witnessed by the CONTRACTING OFFICER and/or his designated representative, and by a representative of ANG/CETSC.

***2** **10. Prior to testing provide calibration certificate for all testing equipment.**

***2** **11. Manufactures representatives shall be present for preliminary and final tests.**

***2** **12. Calibration Certificate; G**
All testing equipment shall be calibrated by a certified testing laboratory within the 6 month period prior to the test. Calibration certification shall be provided at the time of testing for all testing equipment.

B. CONTRACTOR Testing:

1. Prior to final acceptance testing of the installation, the CONTRACTOR shall as a minimum, conduct the following tests:
   a. Flushing and hydrostatic tests.
   b. HEF solution concentration testing.
   c. Meggering of all circuits before final terminations are made. The CONTRACTOR shall provide a megger test report prior to final terminations.
   d. Setting and adjusting of all valve supervisory (tamper) switches.
2. The CONTRACTOR may conduit other tests to assure that the systems are ready for final acceptance testing.
3. Test Reports:
   a. A letter from the CONTRACTOR certifying successful completion of the required CONTRACTOR tests shall be supplied to the CONTRACTING OFFICER at least 21 working days prior to the final acceptance testing. The letter shall state that the installed systems are complete, fully tested and ready for final acceptance testing.
   b. The CONTRACTOR shall submit a test report in booklet form to the CONTRACTING OFFICER with the letter certifying completion of CONTRACTOR tests. The report shall describe all tests conducted and the results of the tests.

C. Final Acceptance Tests:

1. The CONTRACTING OFFICER, the CONTRACTING OFFICER and/or designated representatives shall observe all tests.
2. No final acceptance testing shall be conducted prior to the successful completion of all CONTRACTOR tests.
3. All final acceptance tests shall be conducted on a continuous, consecutive day basis.
4. The final acceptance tests shall consist of the following as specified:
   a. HEF solution concentration testing.
   b. Complete functional testing of all mechanical components.
   c. Foam Control system testing.
   d. Discharge test of the HEF system.
5. The CONTRACTOR shall submit a final acceptance test report in booklet form to the CONTRACTING OFFICER. The report shall describe all tests conducted and the results of the tests.

D. Flushing and Hydrostatic Pressure Tests (CONTRACTOR Test):

1. All piping shall be flushed at no less than 3 meters per second.
2. All systems shall be hydrostatic tested at not less than 2070 kPa for 2 hours. The test pressure shall be read from a gage at the low elevation of the system. No leakage is permissible.

3. The CONTRACTOR shall measure and record the flow rates and pressures.

E. HEF Solution Concentration Test (CONTRACTOR Test and Final Acceptance Test)

1. The following minimum items shall be provided by the CONTRACTOR:
   a. Three 100 ML graduated tubes.
   b. Two measuring pipette (10 ML capacity).
   c. One hand refractometer – Reichert catalog number 10419. No “or equal” product substitutions are acceptable.
2. Test Procedures:
   a. Draw samples of HEF concentrate and water from the system in separate clean containers. HEF concentrate shall be drawn from the HEF concentrate storage tank.
   b. Mix five control sample solutions of HEF and water with the following concentrations:
      1) 0 percent (water only).
      2) 0.75 percent.
      3) 1.75 percent.
      4) 2.75 percent.
      5) 3.75 percent.
      6) 4.75 percent.
   c. Determine refractometer reading for each control sample solution listed above. Record these refractometer readings.
   d. Compare recorded control sample solution refractometer reading with readings obtained from nozzle test sample solutions of HEF and water.
   e. The test concentrations shall be within the limits of 2.75 to 3.5 percent.
   f. Any test concentrations that are above or below the specified limits constitute test failure. This voids any other successful concentration tests. The CONTRACTOR shall repeat the CONTRACTOR concentration tests until successful. A new HEF solution concentration test shall be required for final acceptance.
   g. Temperature of the test or control samples shall not be considered a factor in determining the accuracy of the HEF proportioning.
   h. Test sample collection, control sample preparation and all refractometer readings shall be witnessed and verified by a representative of the CONTRACTING OFFICER.

F. HEF Discharge Test (Final Acceptance Test):

1. The CONTRACTOR shall position a minimum of 8 measuring stands throughout the hangar, which are clearly marked at a height of 1 meter above floor level. Ladders are acceptable as test stands. The 1 meter level shall be prominently marked so as to be easily observable from all areas of the hangar during the test.
2. The hangar doors shall be in the fully closed potion at the start of the test.
3. The CONTRACTOR shall initiate the HEF discharge using a manual HEF release station. The CONTRACTOR shall record the passage of time as the foam is discharged.
4. The HEF discharge shall continue until all measuring stands show a minimum of 1 meter of foam depth in all areas of the hangar to the satisfaction of the CONTRACTING OFFICER (or his designated representative). At that time, the

CONTRACTOR shall halt the HEF discharge, and record the duration of HEF discharge in minutes and seconds.

5. To pass the test of this specification the HEF system must accomplish the 1 meter minimum foam depth in a discharge duration time of 4 minutes or less.
6. If the HEF discharge duration time is greater than 4 minutes, the test shall be considered failed. In the even of a failed HEF discharge test, the CONTRACTOR shall modify the system and repeat the test until the system produces a passing result.

G. Control System Testing (CONTRACTOR Test and Final Acceptance Test)

1. System testing shall include operational and supervisory testing of all control equipment, HEF manual activating stations, indicating appliances, system wiring, and power supplies.
2. Receipt of all alarm and trouble signals, initiated during the course of testing, shall be verified at the fire alarm control panel.
3. Correct labeling of all fire alarm panel annunciation shall be verified.
4. 100 percent successful performance during Final Acceptance Testing is expected. In the event of system performance inconsistent with the CONTRACTOR'S letter of system certification, the CONTRACTING OFFICER and/or his designated representative will make a determination as to whether or not the test results constitute failure of the final acceptance test. Failure of the final acceptance test shall invalidate the CONTRACTOR'S letter of system certification, in which case recertification (including 100 percent CONTRACTOR retesting) and a repeat of the final acceptance test shall be required at no additional cost to the Government.

3.11 DEMONSTRATION - TRAINING

A. Initial Operator Training: The CONTRACTOR shall conduct two training sessions of 4 hours each to familiarize Government personnel with the features, operation and maintenance of the HEF systems. Training sessions shall be scheduled by the Government at a time mutually agreeable to the CONTRACTOR and the CONTRACTING OFFICER.

B. Training Agenda: The CONTRACTOR shall submit a proposed training agenda for the CONTRACTING OFFICER'S review and approval within 60 days of authorization to proceed. The proposed training agenda shall include the following:

1. Overview of system operation.
2. Overview of system equipment and device locations.
3. Manual controls (manual HEF discharge stations and valve operation).
4. Manual operation, testing and maintenance of deluge valves and the automated HEF concentrate valve.
5. User operation of control panel (alarm acknowledgement, alarm silence, reset, alarm resound).
6. Draining and filling procedures for the HEF tank.
7. Review of the Operation and Maintenance Manual.
8. Detailed maintenance procedures.
9. Periodic testing procedures.

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